

### **REMARKS**

The Applicants and the undersigned thank Examiner Alsomiri for a careful review of this application. Consideration of the present application is respectfully requested in view of the following remarks, which are responsive to the Official Action mailed April 21, 2004.

Claims 1-20 are pending in the present application. The independent claims are 1, 8, 13, 15, and 18. Applicants have amended Claims 8 and 13 to correct grammatical and typographical errors. No new matter has been added.

#### **I. The specification enables one skilled in the art to make and use the invention of Claims 1-20.**

The Examiner rejected Claims 1-20 based on the assertion that these claims fail to comply with the enablement requirement of 35 U.S.C. § 112, because the specification allegedly does not describe the “pair of detectors” recited by these claims. Applicants offer the following remarks to traverse the pending rejections.

The specification of the present application does describe the pair of detectors recited in Claims 1-20 in a way that enables one skilled in the art to make and use the invention of these claims. Figure 3 of the application is a block diagram illustrating an exemplary phase-based sensing (“PBS”) system 100 that comprises a sensor-detecting unit (“SDU”) 310. See Figure 3 and page 8, lines 7 – 10 of the application. As evidence of the discussion in the specification of the pair of detectors with reference to Figure 3, Applicants refer the Examiner to page 8, lines 21 – 29, which is quoted below for the Examiner’s convenience with underlines added for emphasis.

The SDU 330 preferably emits microwave signal 321 directed orthogonally at the target object. The reflected microwave signal 320 is received by two mixers in the SDU 310. In other embodiments, a greater number of mixers, alternatively described as detectors, can be used in the SDU 310 to increase the amount of information pertaining to object motion and thus provide, among other benefits, enhanced measurement resolution and signal to

noise at the output of the SPU 330. The mixers are spatially separated, preferably by 90 degrees, to provide for, in the case of two mixers, an inphase signal (I) and a quadrature signal (Q), as will be described in further detail below. (emphasis added)

In addition, Figure 4 of the application presents a schematic view of the exemplary SDU 310 for the PBS system 100 illustrated in Figure 3. The illustrated SDU 310 includes a pair of detectors 450, as discussed in the specification. Page 9, lines 18 – 20 of the application recites, “The SDU 310 includes a set of mixers 450, alternatively described as detectors, with a preferred electrical separation of 90 degrees apart in phase referenced to the transmitted signal wavelength, and a microwave generating source 440.”

As further evidence of the application’s enabling disclosure of a pair of detectors, Applicants refer the Examiner to page 9, line 36 through page 10, line 6, quoted below, for an example of the application’s detailed description referencing Figure 4.

Although described herein as mixers, other non-linear devices can be used to perform this demodulation. Further, combinations of detector diodes in different configurations can be used for increased sensitivity, such as for example, balanced mixers, double balanced mixers, crystal detectors, Schottky diodes, etc. (emphasis added)

In summary, Applicants respectfully submit that the application discloses and describes a pair of detectors, as recited by the pending claim set, by presenting a detailed and enabling description explicitly using the term “detectors” and, in the alternative, using the term “mixers,” which are known to those of skill in the art as detectors. Applicants submit that mixers and detectors are sufficiently known in the art to enable one of ordinary skill in the art to make and use the invention of Claims 1-20 based on the disclosure presented in the drawings and specification. Accordingly, Applicants respectfully request that the Examiner withdrawn the pending rejection of Claims 1-20.

## II. Independent Claims 1, 8, and 13 are patentable over the *Locke* patent

The Examiner rejected independent Claims 1, 8, and 13 and respective dependent Claims 2-7, 9-12, and 14 based on the assertion that these claims are anticipated by U.S. Patent No. 5,406,842 to Locke. Applicants offer the following remarks to traverse the pending rejections.

### A. Independent Claims 1 and 8 are distinguishable from *Locke*

Claim 1 is an independent claim defining a method for obtaining a distance to a target using a sensing system having a signal source, an antenna, and at least a pair of detectors. Claim 8 is an independent claim reciting a phase-based radar system that obtains a distance to a target. Applicants respectfully submit that Claims 1 and 8 are not anticipated by *Locke* because each of these claims recites features that are neither taught nor suggested by *Locke*.

Although Claims 1 and 8 require a pair of detectors, Applicants respectfully submit that *Locke* fails to disclose or suggest a pair of detectors. While *Locke* may refer to in-phase and quadrature outputs, *Locke* teaches generating such outputs using a discrete Fourier transform (“DFT”) algorithm and other algorithms that processes signals from a single detector, not from a pair of detectors. See *Locke* Abstract. In contrast to the inventions of Claims 1 and 8, Figure 3 of *Locke* illustrates a single balanced detector 10 labeled as a microwave mixer 10, not a pair of detectors. See *Locke* Figure 3 and column 4, lines 65-66.

Applicants respectfully disagree with the Examiner’s assertion that *Locke* uses the terms “in-phase” and “quadrature” to refer to each detector in a pair of detectors. Applicants submit that *Locke* uses the terms “in-phase” and “quadrature” in a conventional manner to refer respectively to odd and even numbered digital samples of signals from a single detector for input to a DFT algorithm, not from a pair of detectors. In contrast to processing signals from a pair of detectors, as required by Claims 1 and 8, *Locke* teaches the use of “odds” or “in-phase” signals, from a single detector as real inputs into a signal processing algorithm and using “evens” or “quadrature” signals, from the same, single detector as imaginary inputs into the algorithm. See *Locke* column 5, lines 31 - 47 and column 7, lines 62 - 64. There is no teaching or suggestion in *Locke* to use more than one detector to support the signal detection function in *Locke*.

In view of the foregoing, Applicants respectfully submit that *Locke* fails to disclose or suggest a pair of detectors to detect reference and received signals as required by Claims 1 and 8. Applicants request that the Examiner withdraw the rejection of Claims 1 and 8 and all claims dependent therefrom.

**B. Dependent Claims 2 - 7 and 9-12 are distinguishable from *Locke***

Claims 2-7 and 9-12 depend from Claims 1 and 8 respectively and, therefore, incorporate the respective recitations of these independent claims. In view of the above-described distinctions between the reference cited by the Examiner and Claims 1 and 8, Applicants respectfully submit that dependent Claims 2-7 and 9-12 are patentable over *Locke*. Furthermore, Claims 2-7 and 9-12 recite features further distinguishing the inventions of each of these claims from *Locke*.

**Claims 3 and 10**

In addition to the respective recitations of independent Claims 1 and 8, dependent Claims 3 and 10 each recite obtaining a distance to a target that comprises an antenna and sweeping a frequency band that comprises the stopband of the antenna. *Locke* neither discloses nor suggests obtaining a distance to a target antenna or sweeping a stopband of the antenna.

Applicants respectfully disagree with the Examiner's assertion that *Locke* teaches a frequency band comprising the stopband of an antenna. *Locke* does not teach transmitting in the stopband of an antenna. Instead, *Locke* teaches avoiding transmission in the stopband of an antenna by using an antenna with a sufficiently wide bandwidth to support the transmitted waveform. Applicants submit that column 3, lines 48-52 of *Locke*, which the Examiner referenced as support for teaching a stopband of an antenna, in fact presents a contrasting disclosure by teaching the use of an antenna constructed "to have the bandwidth necessary to support the transmitted waveform." A waveform transmitted in the bandwidth of an antenna, as disclosed by *Locke*, can propagate through the antenna. In contrast, the stopband of an antenna can reflect a transmitted waveform, as described in Figures 5A and 12 of the present patent application, rather than propagate a waveform through the antenna. *Locke* discloses the

transmission of a waveform that propagates through an antenna, while the invention of Claims 3 and 10 requires sweeping a stopband of an antenna to generate a reflected waveform.

In addition to failing to disclose the sweeping of a stopband of an antenna, *Locke does not disclose obtaining a distance to a target antenna* as recited by Claims 3 and 10. In contrast to obtaining a distance to a target antenna as required by these claims, *Locke* teaches obtaining a distance to a tank level 14 and obtaining a distance to a calibration delay line 20. *Locke's* disclosed signal path to the calibration delay line 20 is diverted from the signal path to the antenna 2; the distance *Locke* obtains to the calibration delay line 20 can be distinct from the actual distance to the antenna 2. *Locke* discloses a coupler 12, between the mixer 10 and the antenna 2, that splits a stepped microwave signal 13 into two signal portions, a first signal portion 21 coupled to a delay line 20 for calibration purposes and a second signal portion 17 coupled to an antenna 2 for transmission to the target surface level 14 of a tank. *Locke* teaches correcting the measured distance to the target surface level 14 of the tank based on the calibration distance to the delay line 20. *See Locke* Figure 3; column 4, lines 25 – 37; and column 7, lines 1-7. This calibration distance to the delay line, as disclosed by *Locke*, is distinguishable from the distance to a target antenna, as recited by Claims 3 and 10 of the present application.

### **Claims 5 and 12**

Claims 5 and 12, which depend from independent Claims 1 and 8 respectively, recite obtaining a distance to a target that comprises an antenna and sweeping a frequency band that comprises the stopband of the antenna. As described above with reference to Claims 3 and 10, *Locke* does not disclose or suggest obtaining a distance to a target antenna or sweeping a stopband of the antenna.

Claims 5 and 12 additionally require the obtained distance to the target antenna to comprise the length of a propagation medium that connects the signal source to the antenna. *Locke* does not disclose obtaining a distance to a target antenna wherein the distance includes a propagation medium that connects the signal source to the antenna, according to the requirements of Claims 5 and 12. In contrast, *Locke* teaches obtaining distances to two targets, a delay line 20 of a calibration target and a target surface level 14 of a tank. In the bifurcated

signal path architecture disclosed by *Locke*, the signal propagation path to the delay line 20 is diverted from the signal propagation path to the antenna 2. While *Locke* may obtain a distance to the calibration delay line 20 via a propagation medium, this obtained distance can be distinct from the actual distance to the antenna 2, because this propagation medium does not connect *Locke*'s signal source 8 to the antenna 2. See *Locke* Figure 3 and column 4, lines 30 – 33.

#### **Claim 6**

Claim 6 depends from Claim 1 and requires a step of calibrating the sensing system by completing a first and a second calibration measurement and subtracting the first calibration measurement from the second to remove environmental effects associated with a propagation medium that connects a signal source to an antenna. Completing the first calibration measurement requires obtaining the distance to the target antenna using the stop band of the antenna, while completing the second calibration measurement requires obtaining the distance to a target item that is in the operating environment of the sensing system. Applicants respectfully submit that *Locke* neither discloses nor suggests the recitations of dependent Claim 6.

Claim 6 is distinguishable from *Locke* because *Locke*, as described above, does not disclose transmitting in the stop band of an antenna and does not disclose obtaining a distance to the antenna. Claim 6 is further distinguished from the cited reference because *Locke* does not teach removing environmental effects associated with a propagation medium that connects a signal source to an antenna by obtaining the distance between the signal source and the antenna. In contrast, *Locke* teaches correcting a distance to a target tank level 14 by measuring a distance to a delay line calibration target 20 along a propagation medium that spans from the source 8 to the delay line calibration target 20 but that does not span to the antenna 2. In *Locke*'s bifurcated signal path scheme, the calibration signal path is diverted to a calibration delay line 20 on the source side of the antenna 2 and does not span to the antenna. Thus, the propagation medium of the calibration signal disclosed by *Locke* does not connect the signal source to the antenna. See *Locke* Figure 3; Abstract; column 4, lines 30 – 33; and column 7, lines 10 – 17.

The Examiner asserts that *Locke* anticipates Claim 6 based on the allegation that *Locke* “inherently” discloses the recited steps of Claim 6. However, the Examiner has failed to present *prima facie* evidence in the form of a specific citation to a portion of *Locke* in support of the

inherency position. Moreover, Applicants respectfully note that the Examiner has not presented evidentiary support, such as a citation to a relevant prior art reference, in support of his position that the steps recited by Claim 6 are inherent within the disclosure of *Locke*. Applicants respectfully traverse the Examiner's position and submit that Claim 6 is distinguished from *Locke* because *Locke* does not inherently or otherwise disclose each and every recited feature in Claim 6.

### **Claim 7**

The invention of Claim 7, which depends from Claim 6, requires repeating the calibration steps recited by Claim 6 at predetermined times to maintain calibrated operations of the sensing system. The Examiner alleges that maintaining calibrated operations by repeating calibration steps at predetermined times is inherent to *Locke*. However, the Examiner has failed to present *prima facie* evidence in the form of a specific citation to a portion of *Locke* in support of the inherency position. Moreover, Applicants respectfully note that the Examiner has failed to present evidentiary support, such as a citation to a relevant prior art reference, in support of his position that the invention of Claim 7 is inherent within *Locke's* disclosure of maintaining calibrated operations of the sensing system by repeating calibration steps at predetermined times.

In rebuttal to the Examiner's allegation, Applicants submit that *Locke* does not disclose, inherently or otherwise, maintaining calibration of a sensing system by repeating calibration steps at predetermined times. Applicants further submit that the calibration teachings of *Locke* contrast with repeating calibration steps at predetermined times as required by Claim 7. As an example of such contrast, *Locke* discloses a measurement signal that contains both ranging and calibrating signals, wherein processing the measurement signal isolates ranging and calibrating frequency components. *Locke's* measurement method involves measuring a distance to the tank level with a ranging frequency signal of the measurement signal, diverting a calibration frequency signal from the measurement signal to the delay line to obtain a delay line distance (apparently each time the system obtains a tank level measurement), and correcting the tank level distance based on the calibration distance. See *Locke* Abstract and column 7, lines 1 – 17.

**C. The inventions of independent Claim 13 and dependent Claim 14 are distinguishable from *Locke***

The Examiner rejected independent Claim 13 and its dependent Claim 14 based on the assertion that these claims are anticipated by *Locke*. Applicants offer the following remarks to traverse the pending rejections.

Claim 13 is a method claim for calibrating a phase-based radar system comprising a signal source, an antenna, and at least a pair of detectors by identifying the length of a propagation medium to an antenna, identifying a distance to a target, and subtracting the length of the propagation medium from the distance to the target to obtain the distance between the antenna and the target. Claim 13 is distinguishable from *Locke* because the claim includes recitations that are neither disclosed nor suggested by *Locke*.

As described above, *Locke* does not disclose a phase-based radar system that includes a pair of detectors as required by the invention of Claim 13. Rather, *Locke* discloses a system for measuring the level of a tank using a single detector.

*Locke* neither discloses nor suggests identifying the length of a propagation medium to an antenna according to the recitations of Claim 13. In contrast, as discussed above, *Locke* teaches calibrating a measurement system by identifying the length of a propagation medium that spans from a signal source to a delay line but that does not span to the antenna. See *Locke* Figure 3 and column 4, lines 30 – 34.

The invention of Claim 13 further requires obtaining a distance between an antenna and a target by subtracting the length of the propagation medium to the antenna from an identified distance to a target. *Locke* does not disclose obtaining a distance between an antenna and a target by subtracting the length of the propagation medium to the antenna from an identified distance to a target. In contrast, *Locke* teaches subtracting a calibration distance to a delay line from a ranged distance to a tank level in a calibration method that reportedly corrects ranging distance error. See *Locke* Abstract and column 7, lines 1 – 17.

Claim 14 depends from Claim 13 and thus is distinguishable from *Locke* at least for the reasons that Claim 13 is distinguishable from *Locke*. Furthermore, Claim 14 recites repeating three steps (a), (b), and (c) of Claim 13 at predetermined times to maintain calibrated operation

of the phased-based radar system. As described above with reference to Claim 7, Applicants submit that *Locke* does not disclose repeating calibration steps at predetermined times to maintain calibrated operation of a phased-based radar system in accordance with the recitations of Claim 14.

Without providing evidentiary support, the Examiner has alleged that repeating the steps recited by Claim 13 at predetermined times to maintain calibrated operation is inherent to *Locke*. Applicants respectfully disagree with this allegation, as discussed above in Applicant's remarks regarding Claim 7, and traverse the Examiner's position.

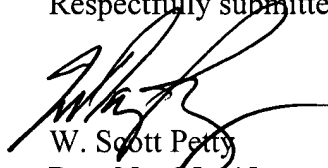
**III. Claims 15 – 20 are in a condition for allowance.**

Applicants thank the Examiner for indicating that Claims 15 – 20 would be allowable if rewritten to overcome the Examiner's pending rejection under 35 U.S.C. § 112, second paragraph related to disclosure of a "pair of detectors." In view of the foregoing remarks in Section I regarding the application's enabling disclosure of a pair of detectors, Applicants respectfully submit that this pending rejection has been traversed and that Claims 15 – 20 are in condition for allowance.

**CONCLUSION**

The foregoing is submitted as a full and complete response to the Official Action mailed April 21, 2004. Applicants thank Examiner Alsomiri for his consideration of the amendments and remarks presented by this paper. Applicants have shown that the pending claims are allowable and allowance of the claims is respectfully requested. It is believed that this response places the application in condition for allowance. Such action is courteously requested. If there are any issues that can be resolved with an Examiner's Amendment or a telephone conference, a telephone call to the undersigned attorney at 404.572.2888 is respectfully requested.

Respectfully submitted,



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